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PTO/SB/05 (4/98)
Approved for use through 09/30/2000. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	402-093.17
First Inventor or Application Identifier	Michael G. ENGLER
Title	System for Extending Length of a Connection.a .US Peripheal
Express Mail Label No.	EL 628 638 103 US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

1. [X] * Fee Transmittal Form *(e.g., PTO/SB/17)* (Submit an original and a duplicate for fee processing)
2. [X] Specification [Total Pages 14*] (preferred arrangement set forth below)
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [X] Drawing(s) *(35 U.S.C. 113)* [Total Sheets 3]
4. Oath or Declaration [Total Pages 2]
   a. [X] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 16 completed)*
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

5. [ ] Microfiche Computer Program *(Appendix)*
6. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. [X] Assignment Papers (cover sheet & document(s))
8. [ ] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
9. [ ] English Translation Document *(if applicable)*
10. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
11. [ ] Preliminary Amendment
12. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
13. [ ] * Small Entity Statement(s) *(PTO/SB/09-12)* [ ] Statement filed in prior application, Status still proper and desired
14. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
15. [ ] Other: .....

16. **If a CONTINUING APPLICATION,** *check appropriate box, and supply the requisite information below and in a preliminary amendment:*

[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: ____/____

Prior application information: Examiner _____ *Group / Art Unit:* _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

[ ] *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or [ ] *Correspondence address below*

Name	Jim Retter WARE, FRESSOLA, VAN DER SLUYS & ADOLPHSON LLP
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City	Monroe
State	CT
Zip Code	06468-0224
Country	
Telephone	
Fax	

Name (Print/Type)	James A. Retter	Registration No. (Attorney/Agent)	41,266
Signature		Date	Sep. 27, 2000

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

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FEE TRANSMITTAL for FY 2000

Patent fees are subject to annual revision.
Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12. See 37 C.F.R. §§ 1.27 and 1.28.

TOTAL AMOUNT OF PAYMENT ($) 385.00

Complete if Known	
Application Number	
Filing Date	Herewith
First Named Inventor	Michael G. ENGLER
Examiner Name	
Group / Art Unit	
Attorney Docket No.	402-093.17

09/670790 09/27/00 09914 U.S. PTO

METHOD OF PAYMENT (check one)

1. [X] The Commissioner is hereby authorized to charge indicated fees and credit any over payments to. for any deficiency
Deposit Account Number: 23-0442
Deposit Account Name:
[ ] Charge Any Additional Fee Required Under 37 CFR §§ 1.16 and 1.17

2. [X] Payment Enclosed: [X] Check [ ] Money Order [ ] Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	690.	201	345.	Utility filing fee	345
106	310.	206	155.	Design filing fee	
107	480.	207	240.	Plant filing fee	
108	690.	208	345.	Reissue filing fee	
114	150.	214	75.	Provisional filing fee	

SUBTOTAL (1) ($) 345.00

2. EXTRA CLAIM FEES

	Extra Claims		Fee from below	Fee Paid
Total Claims	5 -20** =		X	= 0.00
Independent Claims	1 -3** =		X	= 0.00
Multiple Dependent				=

**or number previously paid, if greater; For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	78	202	39	Independent claims in excess of 3
104	260	204	130	Multiple dependent claim, if not paid
109	78	209	39	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0.00

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	380	216	190	Extension for reply within second month	
117	870	217	435	Extension for reply within third month	
118	1,360	218	680	Extension for reply within fourth month	
128	1,850	228	925	Extension for reply within fifth month	
119	300	219	150	Notice of Appeal	
120	300	220	150	Filing a brief in support of an appeal	
121	260	221	130	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,210	241	605	Petition to revive - unintentional	
142	1,210	242	605	Utility issue fee (or reissue)	
143	430	243	215	Design issue fee	
144	580	244	290	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	40.00
146	760	246	380	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	760	249	380	For each additional invention to be examined (37 CFR § 1.129(b))	
Other fee (specify)					
Other fee (specify)					

*Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($) 40.00

SUBMITTED BY				Complete (if applicable)	
Name (Print/Type)	James A. Retter	Registration No. (Attorney/Agent)	41,266	Telephone	(203) 261-1234
Signature				Date	09/27/00

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

EL 628 638 103 US

STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(c))—SMALL BUSINESS CONCERN

Docket Number (Optional): 402-093.17

Applicant, Patentee, or Identifier: Michael G. ENGLER
Application or Patent No.:
Filed or Issued: Herewith
Title: System for Extending Length of a Connection to a USB Peripheral

I hereby state that I am
- ☐ the owner of the small business concern identified below:
- ☑ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN: Lightwave Communications, Inc.

ADDRESS OF SMALL BUSINESS CONCERN: 100 Washington Street, Milford, CT 06460-3133

I hereby state that the above identified small business concern qualifies as a small business concern as defined in 13 CFR Part 121 for purposes of paying reduced fees to the United States Patent and Trademark Office. Questions related to size standards for a small business concern may be directed to: Small Business Administration, Size Standards Staff, 409 Third Street, SW, Washington, DC 20416.

I hereby state that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

- ☑ the specification filed herewith with title as listed above.
- ☐ the application identified above.
- ☐ the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern, or organization having rights in the invention must file separate statements as to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

- ☑ Each person, concern, or organization having any rights in the invention is listed below.
- ☐ no such person, concern, or organization exists.
- ☐ each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

NAME OF PERSON SIGNING: DAVID B CHEEVER

TITLE OF PERSON IF OTHER THAN OWNER: PRESIDENT

ADDRESS OF PERSON SIGNING: 100 WASHINGTON ST MILFORD CT 06460

SIGNATURE: David B Cheever DATE: 9-26-2000

EL 628 638 103 US

Attorney Docket No. 402-093.17

PATENT APPLICATION

of

Michael G. Engler

for a

SYSTEM FOR EXTENDING LENGTH OF A CONNECTION TO A USB PERIPHERAL

CERTIFICATE

Date of Deposit: Sep. 27, 2000

Mailing Label No.: EL 628 638 103 US

I hereby verify that this specification, claims and the drawing referred to herein and the enclosed transmittal letter and fee are being deposited with the U.S. Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington DC 20231, and this statement was made with the knowledge that willful false statements and the like are punishable by fine and/or imprisonment under 18 USC 1001 and may jeopardize the validity of the application or any patent issuing thereon.

Printed Name of Person Mailing Paper:

JUDITH SCHICK

Judith Schick

Signature

System for Extending Length of a connection to a USB Device

Field of the Invention

The present invention pertains to the field of hardware for connecting devices, such as a mouse and a keyboard, to a computer, and in particular, to extender hardware (including intelligent systems) to be used in combination with the device connection hardware for providing for connections of such devices over substantially greater distances than the device connection hardware allows by itself.

Background of the Invention

In order to allow for easier connection to a personal computer (PC) of input/output devices, such as a mouse and a keyboard, a standard has been developed to replace the existing so-called Personal System 2 (PS2) standard for such devices. The new standard is called universal serial bus (USB), and its latest version (2.0) sets out how not only low speed devices such as a mouse or keyboard are to be connected, but also how high speed devices such as a digital camera or a scanner are to be connected. USB allows expandability of a PC's capabilities via an external port, eliminating the need for users or integrators to open the system chassis of the PC. USB supports multiple peripheral devices simultaneously, so it allows users to run numerous devices such as printers, scanners, digital cameras and speakers from a single PC. USB also provides for automatic device detection and installation (i.e. plug-and-play).

In providing a specification that would make connection of a device easier (via plug-and-play) and at the same time

providing for a connection that is up to 100 times faster than the original serial port and supports multiple device connectivity, tradeoffs had to be made. One tradeoff is in the maximum allowed length of the connector used to connect a peripheral device to a computer; the cable for a USB peripheral device cannot be greater than 5 meters, although it is possible to connect to a computer up to thirty meters away using for example a series of so-called hub devices or driving the connection at a higher-than-designed-for voltage.

In some applications, it is advantageous to connect a peripheral device, such as a mouse or keyboard, to a computer over distances of up to 10,000 feet. It is not possible to make such a connection using a series of hubs (because USB hub hardware makes possible a connection of only up to thirty meters even using hubs), nor does the prior art generally teach how to make a USB connection over such long distances.

What is needed is a way of extending a connection from a USB peripheral device, or at least a low-speed USB peripheral device such as a mouse or a keyboard, to distances of up to 10,000 feet.

Summary Of The Invention

Accordingly, the present invention provides a system for extending in length a connection from a universal serial bus (USB) peripheral device to a computer beyond the length enabled by the device hardware, the system including: a USB host emulator, for polling the USB peripheral device according to a USB standard protocol, for receiving input provided by the USB peripheral device in response to the polling, for providing the input in a form suitable for transmission via a communications channel, such as serialized form for transmission via a copper

or spread spectrum form for communication as a radiofrequency signal; the communications channel, having an input end and an output end, responsive to the input at the input end, for providing the input at the output end; a USB device emulator, responsive to the input at the output end of the communications channel, and further responsive to polling from the computer, and in response to the polling, for reforming the input into USB format and providing the USB formatted input to the computer according to a USB protocol.

In a further aspect of the invention, the USB host emulator includes: a USB transceiver, for bi-directionally coupling a glue logic module to the USB peripheral device so as to allow polling the USB peripheral device and to allow receiving a report packet provided by the USB peripheral device in response to the polling, the USB transceiver for providing physical interfacing, according to a USB standard, of the attached USB device to the glue logic module; the glue logic module, such as a field programmable gate array, for interfacing the USB transceiver to a control processor; a control processor, for polling the USB peripheral device and for receiving a report packet provided by the USB peripheral device in response to the polling, and further for providing the report packet information in serialized form; a serial peripheral interface (SPI) universal asynchronous receiver/ transmitter (UART), serving as a bus for serial data transmission, for applying the serialized report packet information to a communications port; and the communications port, for applying the serialized report packet information received from the SPI UART to the communications channel.

In another, further aspect of the invention, the USB device emulator includes: a communications port, for receiving the

serialized report packet information received from the SPI UART to the communications channel; a serial peripheral interface (SPI) universal asynchronous receiver/ transmitter (UART), serving as a bus for serial data transmission, for communicating the serialized report packet information to a control processor; the control processor, for receiving and storing the serialized report packet information, responsive to polling from the host computer, for providing the report packet information in packetized format in response to the polling; the glue logic module, such as a field programmable gate array, for interfacing the control processor to a USB transceiver; and the USB transceiver, for bi-directionally coupling the glue logic module to the host computer so as to allow polling of the USB peripheral device and to allow providing a report packet provided by the USB peripheral device in response to the polling, the USB transceiver for providing physical interfacing, according to a USB standard, of the host computer to the glue logic module.

Brief Description of the Drawings

The above and other objects, features and advantages of the invention will become apparent from a consideration of the subsequent detailed description presented in connection with accompanying drawings, in which:

Fig. 1 is a block diagram showing a system according to the present invention for extending the length of a connecting to two USB devices, a USB mouse and a USB keyboard, the system including a USB host emulator component and a USB device emulator component;

Fig. 2 is a more detailed block diagram of the USB host emulator component of the system of the present invention; and

Fig. 3 is a more detailed block diagram of the USB device emulator component.

Best Mode For Carrying Out The Invention

Referring now to Fig. 1, a system for extending in length a connection to a peripheral device according to a universal serial bus (USB) standard is shown as including a USB host emulator 15 connected to a USB confined peripheral such as a USB keyboard 11 or a USB mouse 12, and a USB device emulator 18 connected to a host 20 such as a personal computer (PC) or a sun work station. The USB host emulator 15 responds to each attached USB peripheral 11 12 according to a USB standard. Each USB peripheral device 11 12 is connected to the USB host emulator 15 via a USB cable 13 14. According to the USB standard, a USB host polls attached USB peripherals and, in response, each polled USB peripheral responds with a report packet communicating for example input from a user. The cable 13 connecting the USB keyboard 11 to the USB host emulator 15, and the cable 14 connecting the USB mouse 12 to the USB host emulator 15 has a maximum length of approximately 5 meters when provided according to a USB standard. According to the present invention, the USB host emulator communicates to the USB device emulator 18 over a communications channel 16 not provided according to a USB standard the report packets it receives from the attached peripherals 11 12; the communications channel may be implemented as a wireless communication channel, a copper wire, or an optical fiber, and may be up to for example 10,000 feet. In communicating the report packets to the USB device

emulator 18, the USB host emulator 15 serializes the packets for transmission over the communications channel 16 to the USB device emulator, or otherwise prepares the packets for transmission via the communications channel 16 such as by formatting the packets as a spread spectrum signal for transmission as one form of radiofrequency (RF) signal. The device emulator 18 emulates a USB peripheral, such as a USB keyboard or a USB mouse, and is compatible with both USB host and hub communications, and, in response to receiving a serialized report packet from the USB host emulator 15, the USB device emulator 18 calculates a check sum of the transmitted serialized report packet and, in case of an error, signals the USB host emulator 15 via a return communications channel 17. The USB device emulator 18 stores each serialized report packet it receives from the USB host emulator 15 until it is polled by the host 20. In the preferred embodiment, the USB device emulator 18 emulates a human interface device (HID) compatible USB keyboard and HID compatible mouse, communicating to the host 20 the report packets originally prepared by the actual USB peripheral devices 11 12 via a standard USB connection 19.

Referring now to Fig. 2, the USB host emulator 15 is shown in more detail as including one USB transceiver 21 22 for each attached peripheral device 11 12. Each USB transceiver 21 22 provides all physical USB interfacing to the attached USB peripheral device 11 12. A USB transceiver 21 22 in the preferred embodiment is a host/slave microprocessor chip such as the SL811HS host/slave controller provided by ScanLogic Corporation, a dual-speed USB host/slave controller for use in non-PC devices. A glue logic module 23 provides low level logical interfacing to all attached peripheral devices 11 12, complementing the physical interfacing provided by the USB transceivers 21 22. The glue logic module is more specifically

a field programmable gate array. The glue logic module provides in particular timing interfacing between a control processor 24 and the USB transceivers 21 22. The control processor 24 is programmed to poll the attached USB peripheral devices according to a USB standard (such as for example USB standard version 1.1 or USB standard version 2.0). The control processor 24 receives report packets from the attached peripheral devices in response to its polling of the peripherals and stores the report packets until they are successfully communicated to the USB device emulator 18; in other words, the control processor 24 waits until it receives a confirmation from the USB device emulator 18 that the report packets have arrived with correct checksums. To provide the report packets to the USB device emulator, the control processor 24 serializes the report packet and provides them through a serial peripheral interface (SPI) universal asynchronous receiver/transmitter 26 to a communication port 28 leading to a communication channel 16 between the USB host emulator 15 and the USB device emulator 18. In case of a failed checksum, the USB device emulator 18 signals the USB host emulator 15 over the return communication channel 17. The USB host emulator 15 also includes a status indicator 25 coupled to the control processor 24 so as to signal to a user the status of the control processor, such as for example whether the control processor is receiver or transmitting. In addition, a diagnostic port 27 for the control processor is provided to enable collecting information on the performance and processing of the control processor 24.

Referring now to Fig. 3, the USB device emulator 18 is shown in more detail as including several modules corresponding to modules of the USB host emulator 15. The USB device emulator is essentially a mirror image of the USB host emulator. However, the control processor 34 of the device emulator is

programmed to act as a USB device, instead of a USB host (as in the USB host emulator) and so responds to polling from the host 20 with report packets it receives in serialized form over the communication channel 16 from the USB host emulator. The device emulator includes a communication port 38 to which the communication channel 16 from the USB host emulator and the communication channel 17 leading to the USB host emulator are connected, an SPI UART 37 interfacing the control processor to the communication port 38, a glue logic module 33 providing logical interfacing of the control processor 34 to a USB transceiver 32, the USB transceiver in turn providing the physical interfacing between a USB port 31 and the glue logic module 33. In addition, just as in the case of the USB host emulator, the device emulator includes a status indicator 35 for indicating to the user the status of the control processor 34, and also includes a diagnostic port 36 allowing access by a user to information about the performance and operation of the control processor 34.

In the preferred embodiment, both the USB host emulator 15 and the USB device emulator 18 are each provided in their own protective container in such a way that the status indicators 25 35 are visible to a user, but the diagnostic ports 27 36 cannot be accessed without opening the protective containers.

The USB device emulator is capable of operating standalone in case of a communication failure while it is communicating with the USB host emulator. The USB device emulator satisfies all PC host boot up requirements, allowing normal operation and boot up without first establishing communications with the USB host emulator. When a connection is established, normal operation begins. On the USB host emulator side, status

indicator lights of the USB keyboard flash continuously, alerting the user, until communications is established.

It is to be understood that the above-described arrangements are only illustrative of the application of the principles of the present invention. In particular, the present invention is intended to comprehend a USB host emulator and a USB device emulator with sufficient computing resources to allow extending the length of a connection not only for low-speed devices such as a mouse or a keyboard, but also for high-speed devices such as a scanner; all that is required is to use a USB device emulator and a USB host emulator with greater processing power compared to what is satisfactory for connecting a low-speed device. Numerous other modifications and alternative arrangements from what is disclosed here may be devised by those skilled in the art without departing from the spirit and scope of the present invention, and the appended claims are intended to cover such modifications and arrangements.

What is claimed is:

1. A system for extending in length a connection from a universal serial bus (USB) peripheral device to a computer beyond the length enabled by the device hardware, the system comprising:

a) a USB host emulator, for polling the USB peripheral device according to a USB standard protocol, for receiving input provided by the USB peripheral device in response to the polling, for providing the input in a form suitable for transmission via a communications channel;

b) the communications channel, having an input end and an output end, responsive to the input at the input end, for providing the input at the output end;

c) a USB device emulator, responsive to the input at the output end of the communications channel, and further responsive to polling from the computer, and in response to the polling, for reforming the input into USB format and providing the USB formatted input to the computer according to a USB protocol.

2. A system as in claim 1, wherein the USB host emulator further comprises:

a) a USB transceiver, for bi-directionally coupling a glue logic module to the USB peripheral device so as to allow polling the USB peripheral device and to allow receiving a report packet provided by the USB peripheral device in response to the polling, the USB transceiver for providing physical interfacing, according to a USB standard, of the attached USB device to the glue logic module;

b) the glue logic module, such as a field programmable gate array, for interfacing the USB transceiver to a control processor;

c) a control processor, for polling the USB peripheral device and for receiving a report packet provided by the USB peripheral device in response to the polling, and further for providing the report packet information in serialized form;

d) a serial peripheral interface (SPI) universal asynchronous receiver/ transmitter (UART), serving as a bus for serial data transmission, for applying the serialized report packet information to a communications port; and

e) the communications port, for applying the serialized report packet information received from the SPI UART to the communications channel.

3. A system as in claim 1, wherein the USB device emulator further comprises:

a) a communications port, for receiving the serialized report packet information received from the SPI UART to the communications channel;

b) a serial peripheral interface (SPI) universal asynchronous receiver/ transmitter (UART), serving as a bus for serial data transmission, for communicating the serialized report packet information to a control processor;

c) the control processor, for receiving and storing the serialized report packet information, responsive to polling from the host computer, for providing the report packet information in packetized format in response to the polling;

d) the glue logic module, such as a field programmable gate array, for interfacing the control processor to a USB transceiver; and

e) the USB transceiver, for bi-directionally coupling the glue logic module to the host computer so as to allow polling of the USB peripheral device and to allow providing a report packet provided by the USB peripheral device in response to the polling, the USB transceiver for providing physical interfacing, according to a USB standard, of the host computer to the glue logic module.

4. A system as in claim 1, wherein the form suitable for transmission via the communications channel is a serialized form.

5. A system as in claim 1, wherein the form suitable for transmission via the communications channel is a form used for radiofrequency communications, such as a spread spectrum form.

Abstract of the Disclosure

A system for extending in length a connection from a universal serial bus (USB) peripheral device to a computer beyond the length enabled by the device hardware. The system includes: a USB host emulator, for polling the USB peripheral device according to a USB standard protocol, for receiving input provided by the USB peripheral device in response to the polling, for providing the input in a form suitable for transmission via a communications channel, such as serialized form for transmission via a copper or spread spectrum form for communication as a radiofrequency signal; the communications channel, having an input end and an output end, responsive to the input at the input end, for providing the input at the output end; a USB device emulator, responsive to the input at the output end of the communications channel, and further responsive to polling from the computer, and in response to the polling, for reforming the input into USB format and providing the USB formatted input to the computer according to a USB protocol.

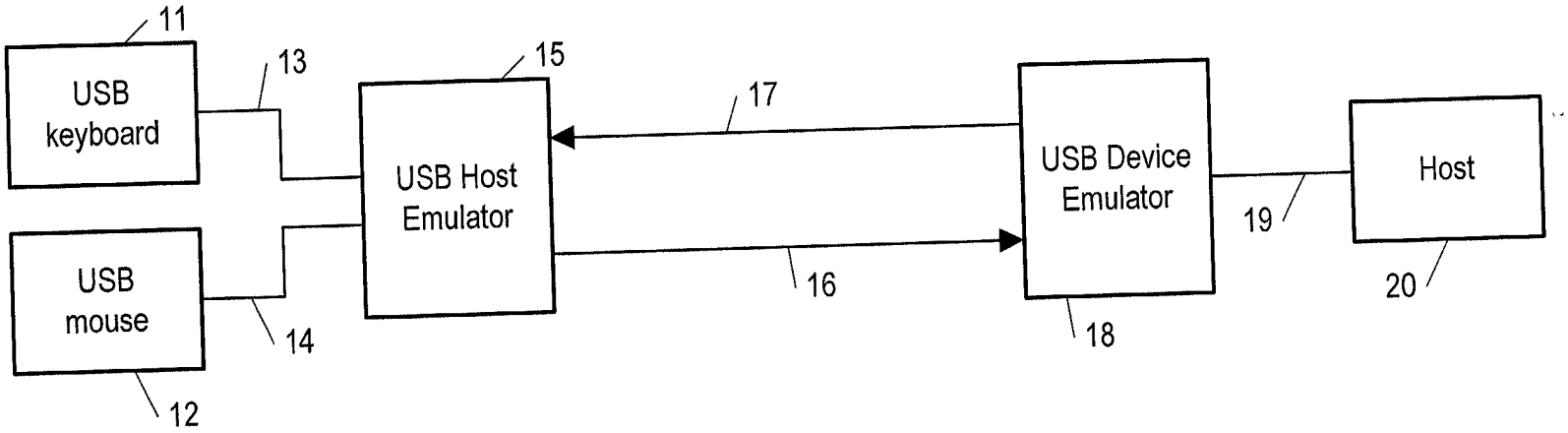
11
USB keyboard
13
15
17
USB Host Emulator
USB Device Emulator
Host
19
20
USB mouse
14
16
18
12

FIG. 1

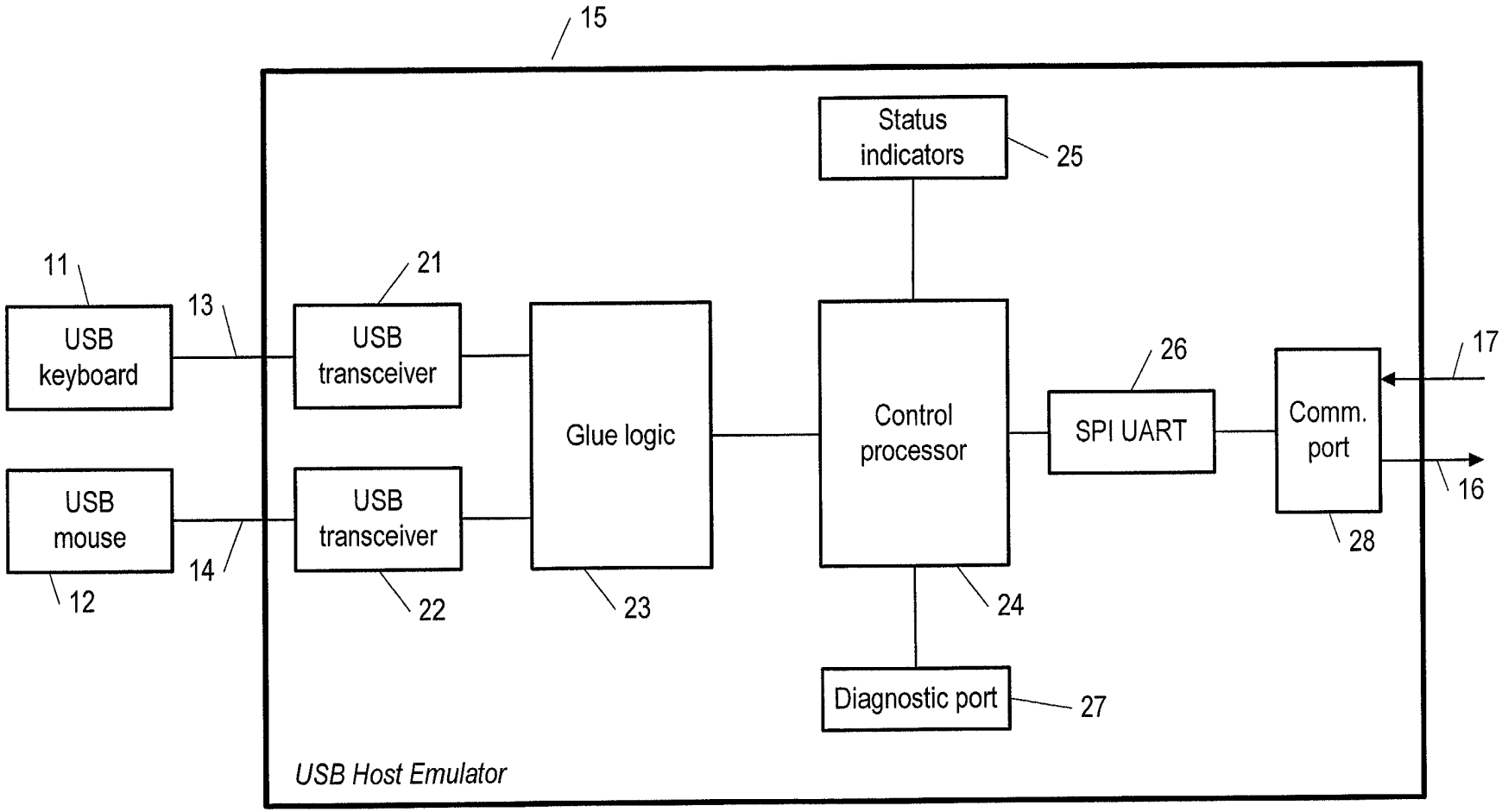
15
Status indicators
25
11
21
13
USB keyboard
USB transceiver
Glue logic
Control processor
26
SPI UART
Comm. port
17
16
USB mouse
USB transceiver
14
12
22
23
24
28
Diagnostic port
27
USB Host Emulator

FIG. 2

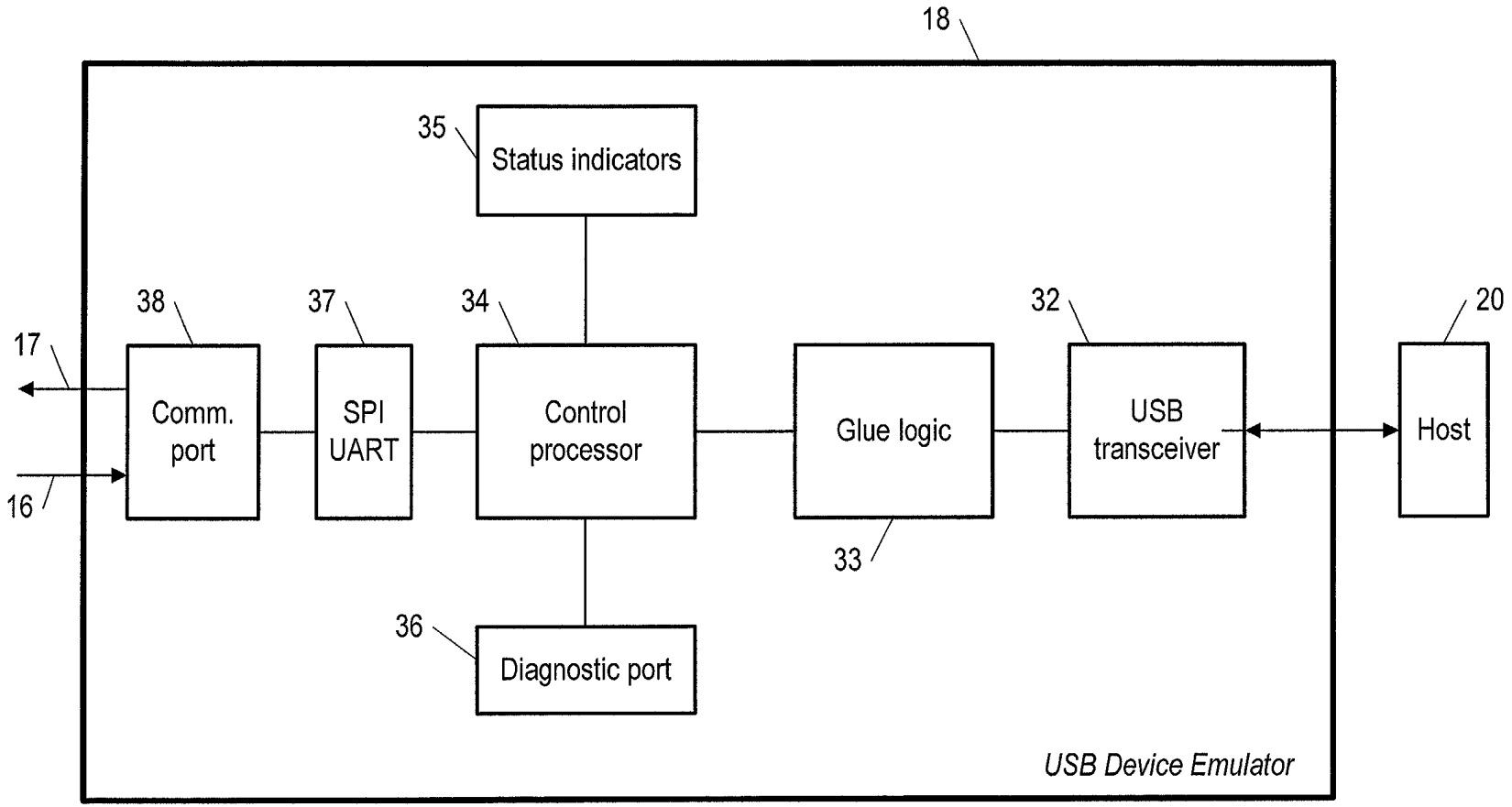
18
35
Status indicators
38
37
34
32
20
17
Comm. port
SPI UART
Control processor
Glue logic
USB transceiver
Host
16
33
36
Diagnostic port
USB Device Emulator

FIG. 3

COMBINED DECLARATION AND POWER OF ATTORNEY

402-093.17
(Docket Number)

As a below named inventor, I hereby declare that:

- my residence, post office address and citizenship are as stated below next to my name;
- I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **System for Extending Length of a Connection to a USB Peripheral**
- the specification of which is attached hereto unless the following box is checked: ☐. If the box is checked,

  the application was filed on
  as U.S. Application Number
  or PCT International Application Number
  and was amended on (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application			Priority Not Claimed
(Application Number)	(Country)	(Day/Month/Year Filed)	☐
(Application Number)	(Country)	(Day/Month/Year Filed)	☐
(Application Number)	(Country)	(Day/Month/Year Filed)	☐

To the extent permitted by rule or law, I hereby incorporate by reference the Prior Foreign Application(s) listed above.

I hereby claim the benefits under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Provisional Application Number)	(Day/Month/Year Filed)
(Provisional Application Number)	(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability, as defined in 37 CFR §1.56, which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)
(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)

I hereby appoint the attorney(s) and/or agent(s) assigned to the customer number listed below, as may from time to time be amended, belonging to the firm of **Ware, Fressola, Van Der Sluys & Adolphson LLP**, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Customer Number

4955 →

Address all telephone calls to: Ware, Fressola, Van Der Sluys & Adolphson LLP at (203) 261-1234. **Address all correspondence to:**

Customer Number

4955 →

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Michael G. ENGLER Full name of sole or first inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Michael G. Engler Inventor's Signature	9/22/2000 Date
Stamford, Connecticut Residence	**USA** Citizenship
Post Office Address: **41 Weed Hill Avenue, Stamford, CT 06907**	

Full name of second inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Residence	Citizenship
Post Office Address:	

Full name of third inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Residence	Citizenship
Post Office Address:	

☐ Additional inventors are being named on separately numbered sheets attached hereto.